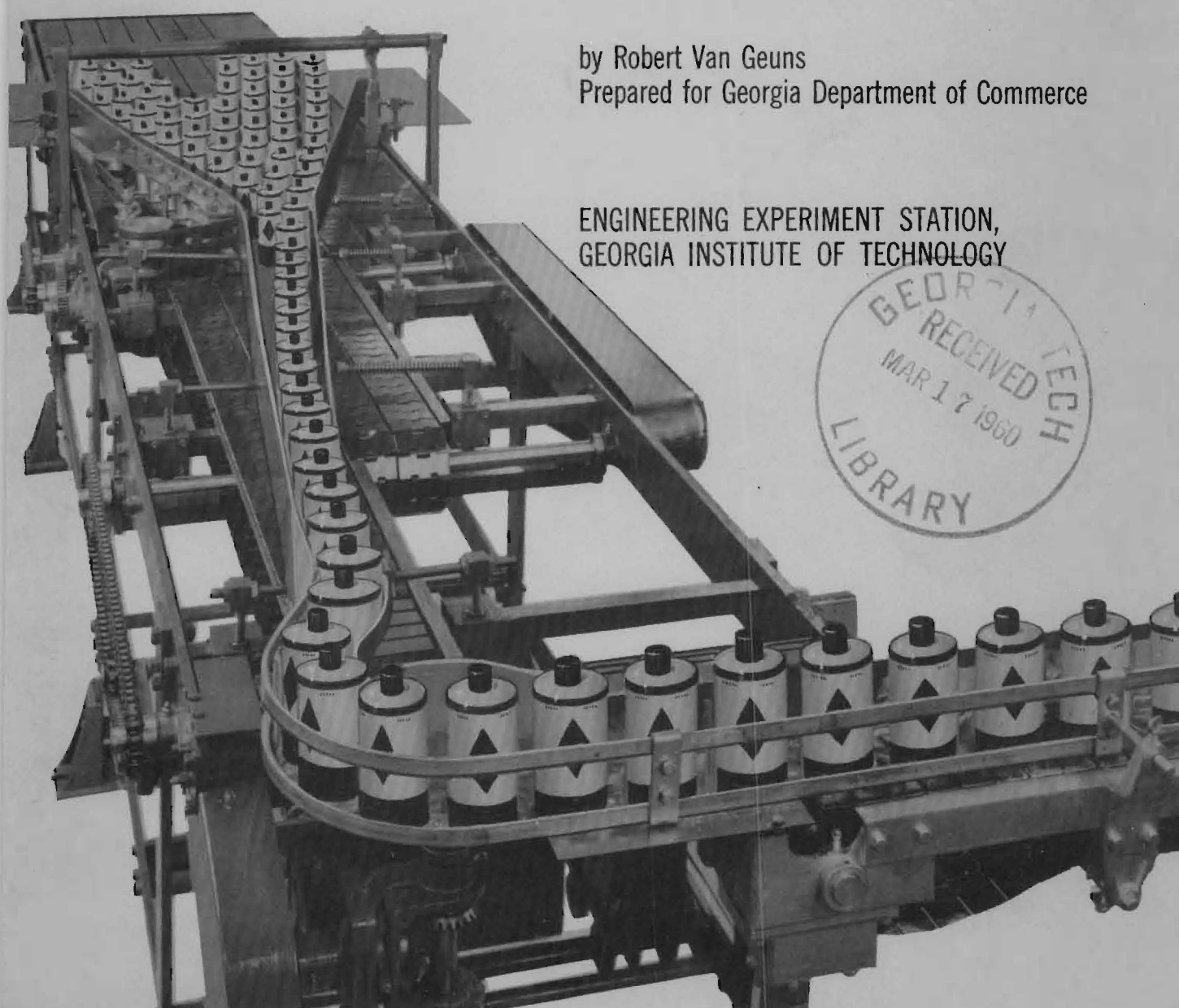
Liquid Detergents

a manufacturing opportunity in Georgia

by Robert Van Geuns
Prepared for Georgia Department of Commerce

ENGINEERING EXPERIMENT STATION,
GEORGIA INSTITUTE OF TECHNOLOGY



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L I Q U I D D E T E R G E N T S

A Manufacturing Opportunity in Georgia

Prepared for
The Georgia Department of Commerce
Abit Massey, Director
100 State Capitol
Atlanta, Georgia

by

Robert E. Van Geuns

Industrial Development Branch
Engineering Experiment Station
Georgia Institute of Technology
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Foreword

The research upon which this report is based was completed in 1958, as noted in the Introduction. An unexpected reduction in the funds anticipated for completion of the project has made a lengthy delay necessary before publication could be completed.

Since there has been no appreciable change in the industry as analyzed some months ago, no attempt has been made to make the relatively minor corrections which would be entailed in bringing the findings completely up to date. The conclusions regarding the desirability of locating a liquid synthetic detergent plant in Georgia should, if anything, be more valid now than they were some months ago.

As always, comments on the report are invited. We would especially like to receive reactions to the quite different approach employed in the analysis--the pointing up of specific advantages to a particular manufacturer in an attempt to make the findings more meaningful. While thus focusing attention on the opportunities open to a particular firm, the approach also makes it easy to note the particular and comparative gains open to other firms in the industry. It is hoped that readers will find this device helpful.

Kenneth C. Wagner, Head
Industrial Development Branch

Acknowledgments

This report would never have come into being without the help of many individuals who gave freely of their time, permitted us to profit from their seasoned judgement, and supplied factual information. This includes many supermarket and grocery store managers and buyers, supermarket central office officials, wholesalers, equipment manufacturers, raw material suppliers, realtors and engineers of bottling plants. It is not possible to list all their names.

However, we want to single out Dr. Kenneth Wagner for many valuable suggestions and criticism and Mr. Frank Longshore for his careful editing of this report. For the fine typing we thank Mrs. Betty Jaffe and Mrs. Elizabeth Morris; for the carefully prepared charts and maps, Mr. Don Swafford.

The Association of American Soap & Glycerine Producers, 295 Madison Avenue, New York 17, N. Y. supplied valuable statistical material. Great benefit was derived from the outstanding article by Mr. John W. McCutcheon: "Heavy Duty Liquid Detergents," Soap & Chemical Specialities, August 1957, page 43.

Introduction

Anyone who studies the industrial structure of the Southeast will be struck by the absence of important soap and detergent plants of the three giants in this field: Colgate-Palmolive, Lever Brothers, and Procter & Gamble. One possible reason is that the Southeast has perhaps not been a large enough consumer of soap and detergents. A second possible explanation could be that the reductions in transport costs which would be gained by a southeastern location might not compensate for the disadvantages which result from decentralization. This study was designed to answer these and related questions vital to determining the feasibility of locating a liquid synthetic detergent (LSD) plant in the Southeast.

While this study was in progress (during the latter part of 1958) a change was taking place in the soap and detergent field. The powdered, packaged synthetic detergents, which have almost completely displaced the soap, flakes and powders for domestic use, were in turn being displaced by the liquid synthetic detergents. The liquid synthetics contain about 50 per cent water, and consequently weigh more than the powdered detergents, so that transportation costs become considerably more important than they are for the solid products. Regional manufacturing plants, therefore, become more practical.

This new situation has been studied, the approximate local market has been established, and decreased transport costs have been weighed against increased investment and manufacturing costs.

In order to get a rough idea of the local market, one small-sized and two medium-sized towns were sampled; buyers for supermarket and grocery chains, as well as detergent wholesalers and managers of individual supermarkets were consulted. In order to make spot-estimates of required investments and manufacturing costs, equipment and raw material suppliers were contacted, realtors consulted, and plants with filling and packaging problems comparable to those of an LSD plant were visited. In all, nearly 100 visits were made.

Summary

Packaged liquid synthetic detergents for home use are becoming increasingly popular and have started to replace the packaged powdered synthetic detergents. At first only light duty products for washing fine fabrics and dishes were marketed, but in the second half of 1956 Lever Brothers launched its heavy duty, all-purpose product "Wisk." The major expansion of the powdered synthetics came when the heavy duty and all-purpose type of powders were introduced. The introduction of the heavy duty and all-purpose liquids may produce a similar expansion of liquid sales.

It was found that the increase of solid packaged synthetic detergent sales (after the introduction of the heavy duty ones) can be represented by a mathematical formula with satisfactory approximation. Future liquid packaged sales were then estimated on the assumption that a similar formula applies to the increase of the liquids. This gives for the U. S the following figures:

Year	Estimated Total U. S. Consumption (Pounds)
1959	594,000,000
1960	730,000,000
1961	907,000,000
1962	1,097,000,000
1963	1,300,000,000
1964	1,513,000,000

Based on a preliminary market survey, yearly liquid synthetic detergent sales in the Southeast were estimated to be approximately 3.0 pounds per capita, a value somewhat higher than the per capita sales for the country as a whole. This would indicate a 1958 consumption for the six-state area studied (Alabama, Florida, Georgia, North Carolina, South Carolina and Tennessee) of about 61,500,000 pounds. Future liquid sales in the six-state area were then calculated from the figures above on the assumption that its share of total national sales will remain about constant.

Year	Estimated Total S. E. Consumption (Pounds)
1959	85,500,000
1960	105,200,000
1961	130,800,000
1962	158,000,000
1963	187,000,000
1964	217,600,000

The liquid synthetic detergents contain roughly 50 per cent water, and are, therefore, much heavier than the powdered detergents. This makes transport costs for the liquids much more important than for the solids. A comparison was made between decreased transport and increased manufacturing costs for the theoretical case of a manufacturer of liquid detergents who puts up a branch plant at or near Atlanta. For the manufacturer who holds the largest share of the Southeastern market (plant capacity 30-100,000,000 pounds per year) it was found that the extra costs of the new Atlanta plant (compared with the cost of expanding facilities at Baltimore, Md.) will be paid back within about one and one-half years. Savings in transport costs for the first years are estimated as follows:

Year	Savings Per Year Dollars	Cumulative Savings Dollars
1959	318,000	318,000
1960	350,000	668,000
1961	436,000	1,104,000
1962	527,000	1,631,000
1963	624,000	2,255,000

Even for a much smaller plant (capacity 15-50,000,000 pounds per year) extra costs for an Atlanta area plant will be returned in approximately three years. The conclusions are:

(1) Operation of a branch plant at Atlanta for one of the big liquid synthetic detergent manufacturers is almost a "must."

(2) Operation of a branch plant for one of the smaller size manufacturer still looks attractive, especially when this plant is made the nucleus around which similar types of manufacturing such as other cleaning compounds, polishing, waxing or sanitary products are grouped.

(3) Local liquid synthetic detergent manufacturing looks attractive for an independent local manufacturer, if he can also produce several other related products.

I. BACKGROUND OF LIQUID SYNTHETIC DETERGENTS

Detergents are compounds which foam when mixed with a solvent (mostly water) and have the cleansing action of soap, but which, unlike soap, are acid and hard water resistant.

Though the first synthetic detergents or "syndets" were prepared quite some time ago, their spectacular rise is a relatively recent occurrence. It was around 1945 that the syndets began to invade the retail market. They were introduced first as light duty powders and flakes for dishwashing and laundering of fine fabrics, in which field they competed with soap products like "Lux" and "Ivory" flakes. One of the first of these syndets to achieve substantial sales was Procter & Gamble's "Dreft." Later on, heavy duty type syndets came on the market for the washing of cottons and for doing heavy duty laundry. "Tide" is one of the best known detergents in this class, which competed against soap products such as "Rinso," and "Super Suds."

The syndets have been able to replace soap because the latter has two serious limitations:

(1) Its calcium and magnesium salts are insoluble in water.

Many waters contain such soluble salts as calcium and magnesium bicarbonates and calcium and magnesium chlorides. When soap is dissolved in these waters the calcium and magnesium salts of the fatty acid contained in the soap are formed. These, being insoluble in water, separate out and soil the materials being washed. Almost everyone is familiar with the action of these salts in the form of the rings which appear in bath tubs and wash basins.

(2) It becomes insoluble in acid solutions.

Soap is the sodium salt of a fatty acid. (Fatty acids are found in animal and vegetable fats; one of the best known sources is tallow.) The fatty acids are rather weak. When soap comes in contact with an acid stronger than the fatty acid it contains, part of the sodium-fatty acid salt is decomposed and free fatty acid enters the solution. But fatty acids are practically all insoluble in water. The result is that they separate out as a solid substance and soil the fabrics or other materials being washed.

It is not surprising that the syndets have displaced soap first in those regions where the water is rather hard (i.e., has a high content of soluble calcium and magnesium salts) or for applications in which the washing solution must be acid.

The invasion of the soap market has now gone so far that of the total soap and syndets sales volume about 70 per cent is in syndets. Nevertheless, this invasion has not yet come to an end. There is a new development at this writing. The major soap companies are now putting on the market syndet toilet bars like "Zest," "Praise," and "Vel." It seems almost certain that in this field, too, the syndets will be successful.

Neither the different types of detergents used at present nor theoretical explanations of detergency will be examined. For the purpose of this report it will suffice to indicate that the majority of the syndets used in the home contain an active ingredient which to the chemists is an alkyl-aryl sulfonate. The majority of these alkyl-aryl sulfonates in turn are sodium dodecyl benzene sulfonates.

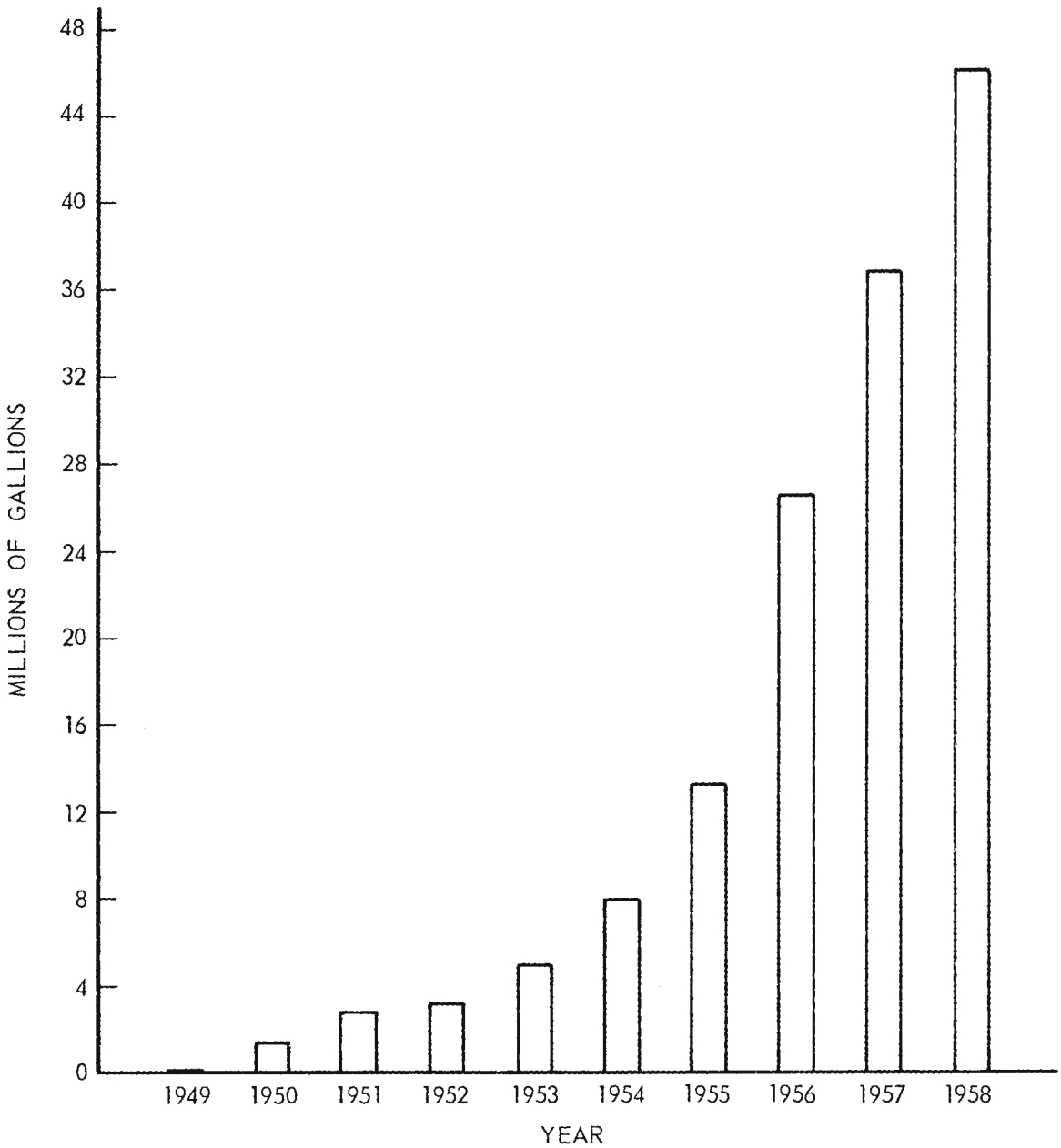
Most manufacturers of syndets buy dodecyl benzene, a petroleum refinery by-product, sulfonate it and then formulate the final product. Some synthetic detergent producers buy sulfonated dodecyl benzene from a refinery or from a chemical manufacturer and only carry out the formulating, filling, and packaging stages. Most of the detergent formulations contain appreciable amounts of sodium phosphates (approximately 40 per cent). The most popular phosphate for this purpose is sodium tripolyphosphate (STPP). It increases the detergent or cleaning power of the active ingredient. Another component of many syndets is the sodium salt of caboxy methyl cellulose (CMC). It prevents the redisposition of soil.

The production of synthetic detergents is big business. The yearly survey of the Association of American Soap and Glycerine Producers, Inc., (hereafter referred to as the "Association") found that sales of synthetic detergents for 1958 amounted to $715,951,000. (This represents sales of detergents with end uses similar to soap.)

Within the synthetic detergent field a major change is taking place--solid syndets are gradually being replaced by liquid. The rapid rise of the liquid synthetic detergents (LSD) can best be appraised from a graph, Chart No. 1, published by the Association, showing sales of LSD for each year. These figures are based on surveys which cover a sample of manufacturers in the field. For this reason the figures for different years are not strictly comparable. Yet the trend shown by the graph probably corresponds fairly closely with actual trends.

The first LSD's to appear were the light duty types, for dishwashing and laundering of fine fabrics. Initially the liquid products were offered in

CHART 1
SALES OF PACKAGED L.S.D.



glass bottles, but they soon appeared in the now familiar 12-ounce, pint, 22-ounce, quart and 1/2 gallon cans. These cans have a no-drip plastic spout.

Early in 1956 Lever Brothers launched its heavy duty type liquid detergent, "Wisk," on a test market. It proved to be such a success that Procter & Gamble is now market testing its heavy duty "Biz." These products are intended for cottons and heavy duty laundering.

The real invasion of the soap market by the syndets started when the heavy duty powders were introduced. It is quite possible that the same will be true for the invasion of the solid syndets market by the liquids. The launching of "Wisk" and "Biz" is expected to mark the beginning of a phenomenal increase in LSD sales.

Based on figures reported by the Association, the packaged LSD sales for 1958 are estimated to be about 427,000,000 pounds or $144,000,000. (See the section on "The Southeastern Market" in Chapter II.)

LSD's have become popular in the homes because of the following advantages:

(1) Convenience in handling.

(2) Instant solubility in hot or cold water.

(3) Easy spot cleaning of stains. (It is easier to apply the liquid to a small spot than the powder.)

(4) Special ingredients like bluing can be incorporated in higher concentrations without danger of local spotting on the clothes.

(5) More attractive package appearance. The cans look better than the cardboard boxes, especially after the latter have been handled for some time. The success of the LSD's proves that these advantages outweigh the following disadvantages:

(1) In order to perform the same amount of washing the housewife has to take home almost twice as much weight of liquid as of solid detergent, although much less bulk is involved.

(2) For an equivalent amount of washing the cost of the liquid product is generally considered to be higher.

The above suggests that the liquids are going to take over the market from the powders and soaps now used in the homes. It seems doubtful that they will be used in laundries, with the possible exception of the self-service ones. For laundries cost is the most important factor, and here the liquids are at a definite disadvantage.

II. MARKET POTENTIALITIES

The National Market

Under the previous heading "Background of Liquid Synthetic Detergents," it was explained that the LDS's will dominate the domestic market now held by solid syndets. This assumption permits estimation of the final saturation volume of liquids, provided the final combined volume of the solids and liquids is known or can be estimated.

The Association, for the period 1948 to 1958, published figures for the yearly sales of packaged solid syndets. To these figures LSD sales for the same period were added, expressed as equivalent pounds of solid syndet. These totals were converted to per capita sales (y) with some adjustments, details of which are given in Appendix A. An attempt was then made to express the resulting growth curve by an equation of the Pearl-Reed or Gompertz type. Neither fitted the data, however. After further trials, it was found that an equation of the following type fits the data well:

$$y = 10^{(\frac{a}{x} + b)}$$

After determination of the constants, the following formula was derived:

$$y = 10^{(1.494 - \frac{3.933}{x - 1945})} + 1.78,$$

where y stands for the per capita sales of packaged syndets expressed as pounds of solid syndet, and x stands for the year. (The term 1.78 represents per capita sales in 1947.) The equation attempts to capture the growth picture of the heavy duty detergents, which were introduced on a large scale in 1948.) Per capita sales calculated with this formula check reasonably well with the published figures. (Three times the standard deviation is greater than the maximum deviation, indicating a satisfactory fit.) Chart No. 2 shows both the actual and the calculated values.

This formula gives a saturation volume of 32.97 pounds per capita. This volume is approached rather slowly as shown in the following tabulation and Chart No. 4.

CHART 2
PER CAPITA SALES OF PACKAGED SYNTHETIC DETERGENTS.
(1947 = 0)

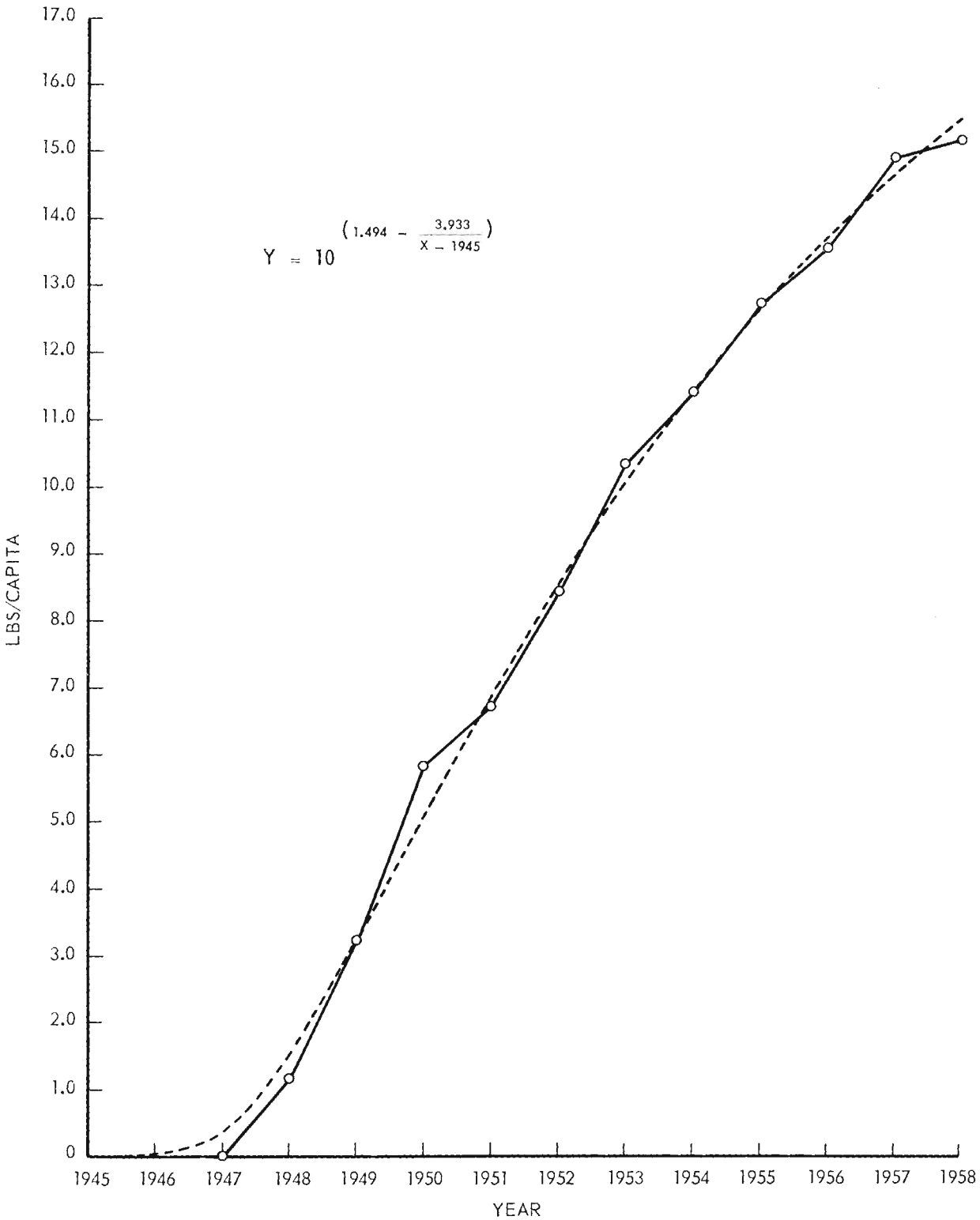


CHART 3
PER CAPITA SALES OF L.S.D.

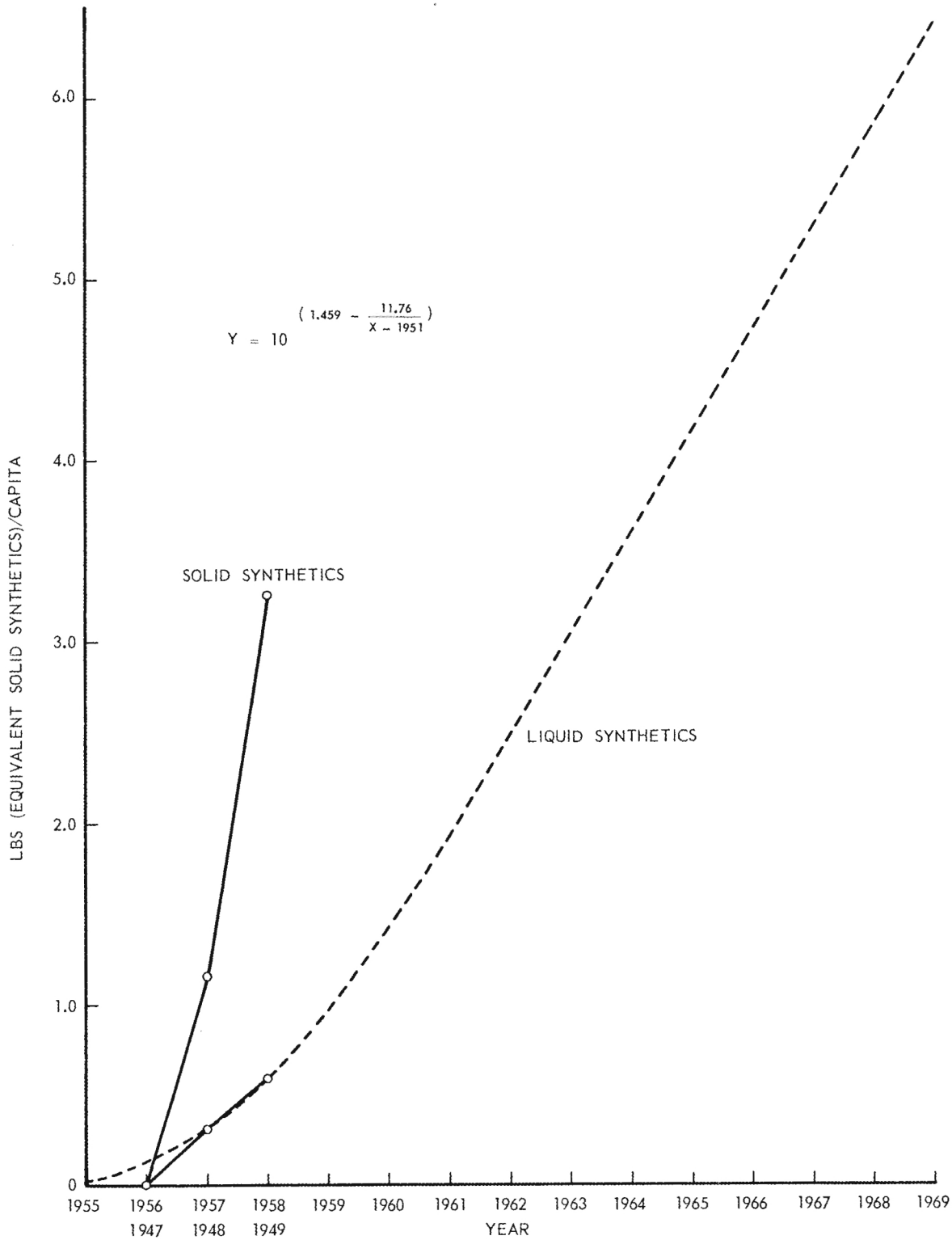
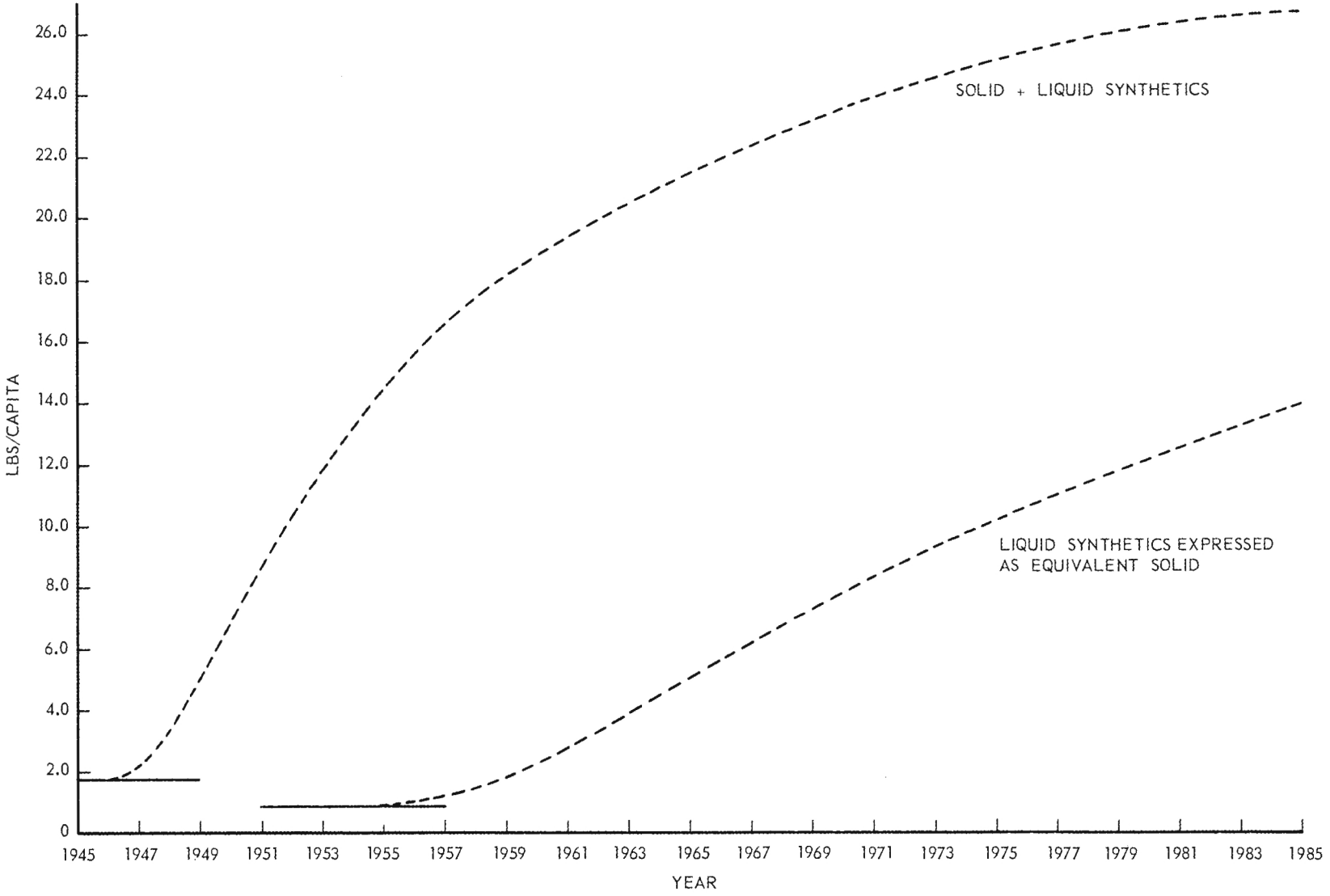


CHART 4
ESTIMATED FUTURE SALES OF PACKAGED SYNTHETICS.



Year	Detergent Sales (pounds/per capita)
1960	18.65
1970	23.51
1980	25.88
1990	27.31
2000	28.20

In order to estimate future LSD sales it was assumed that they can be expressed by a formula of the same type as used for the solids, using as the base year, the year that the first heavy duty LSD's were put on the market (Lever's Wisk). Then, assuming that the liquids will ultimately represent 90 per cent of the syndet sales, the following formula is suggested to depict their growth:

$$y = 10^{(1.459 - \frac{a}{x - c})} + 0.88$$

(0.88 represents per capita LSD sales in 1956).

The final saturation volume is then $10^{1.459} + 0.88 = 29.67$ pounds. Chart No. 3 shows the actual growth of per capita LSD sales after the introduction of the heavy duty product (from 1956 onwards), expressed as equivalent pounds of solid syndet. It also indicates the growth of the solid packaged syndets for the first two years after the large scale introduction of the heavy duty product (from 1947 onwards).

It is immediately apparent that the curve for the solids rises much more steeply than that for the liquids. Furthermore, the curve for liquids shows the anomaly that it rises less steeply the second year than the first year. This might have been caused by the recession. When this anomaly is corrected, the initial rise of the liquids goes at a rate of about one-third to one-fourth that of the solids. On this basis the following formula depicts future growth of LSD sales:

$$y = 10^{(1.459 - \frac{11.76}{x - 1951})} + 0.88$$

Chart No. 4 shows the future per capita sales of the solid and liquid packaged detergents as calculated from the two formulas. From the formula for the LSD the following yearly sales, expressed as actual pounds of liquid detergents were calculated:

Year	Pounds of Liquid Detergent
1959	594,000,000
1960	730,000,000
1961	907,000,000
1962	1,097,000,000
1963	1,300,000,000
1964	1,513,000,000
1965	1,735,000,000
1966	1,966,000,000
1967	2,190,000,000
1968	2,420,000,000
1969	2,655,000,000

At best these figures are rough estimates. In the first place it was assumed that the figures published by the Association for different years are comparable, and this is not strictly correct. Furthermore several assumptions were introduced which cannot be completely proved. These figures present the best estimate that can be made at the moment, and should be revised as additional data become available. Because LSD plants have capacities which can vary within wide limits without affecting the profitability of the operation (see note at the end of Chapter IV), even deviations of some importance from these estimates only slightly affect calculations of required plant size.

The Southeastern Market

It is reasonable to assume that an independent Georgia manufacturer of LSD would sell first to the local area market--Alabama, Florida, Georgia, North Carolina, South Carolina and Tennessee. He naturally would need to know how much LSD is sold in this area. While figures for LSD sales in the Southeast are not available, it is possible, as a first approximation, to estimate local figures from national ones on the assumption that per capita consumption for different areas is about equal.

The most recent figures on LSD sales are those published by the Association. For 1958 they indicate packaged LSD sales of 46,086,000 gallons. Comparing their LSD figures for 1954 with those of the Census of Manufactures of the same year, it is estimated that the Association's figure represents about 95 per cent total sales, which gives a corrected 1958 figure of about 48,600,000 gallons or 427,000,000 pounds. Based on the 1958 estimated population for continental United States this gives a per capita consumption of 2.46 pounds per year. The six-state unit indicated above, had an estimated

population of about 21,000,000 in 1958. If the per capita consumption of LSD is the same for the Southeast as for the country as a whole, the estimated southeastern market for packaged LSD in 1958 would be about 51,600,000 pounds.

This estimate of the southeastern market is only an approximation. Per capita consumption for the Southeast may not be the same as in other areas. Some interviewees claimed that soap and detergent sales in the Southeast are below the national average. It was, therefore, imperative to make some kind of a preliminary market survey in order to have a check on the above estimate. The preliminary survey consisted in determining total LSD sales in two medium-sized and one small-sized town. All the important groceries and a large percentage of the small ones in these towns were visited. The data obtained for the towns were then recalculated for the whole county using retail sales data of Sales Management's 1958 Survey of Buying Power and the 1954 Census. (For details see Appendix B.) The results were:

County	County Seat	County Population	Per Capita LSD Sales (pounds/year)	Percentage of Urban Population in County
Upson	Thomaston	24,000	3.6	52.0
Whitfield	Dalton	37,700	3.3	46.4
Walton	Monroe	18,000	2.2	22.5

It is interesting to note that the per capita sales figures increase when the percentage of urban population increases. Chart No. 5 shows graphically that the points fall on a straight line. Admittedly, many more towns of widely different percentage of urban population would have to be sampled in order to verify whether a linear relationship actually exists.

A full scale market survey is, however, beyond the scope of this study. Because the interest here is only in order-of-magnitude figures, the assumption is that this linear relationship is valid. It is, therefore, used to establish an approximate per capita figure for the six-state unit.[1/] The latter has 44.3 per cent urban population. Chart No. 5 shows that this corresponds to a per capita consumption of packaged LSD of around 3.2 pounds

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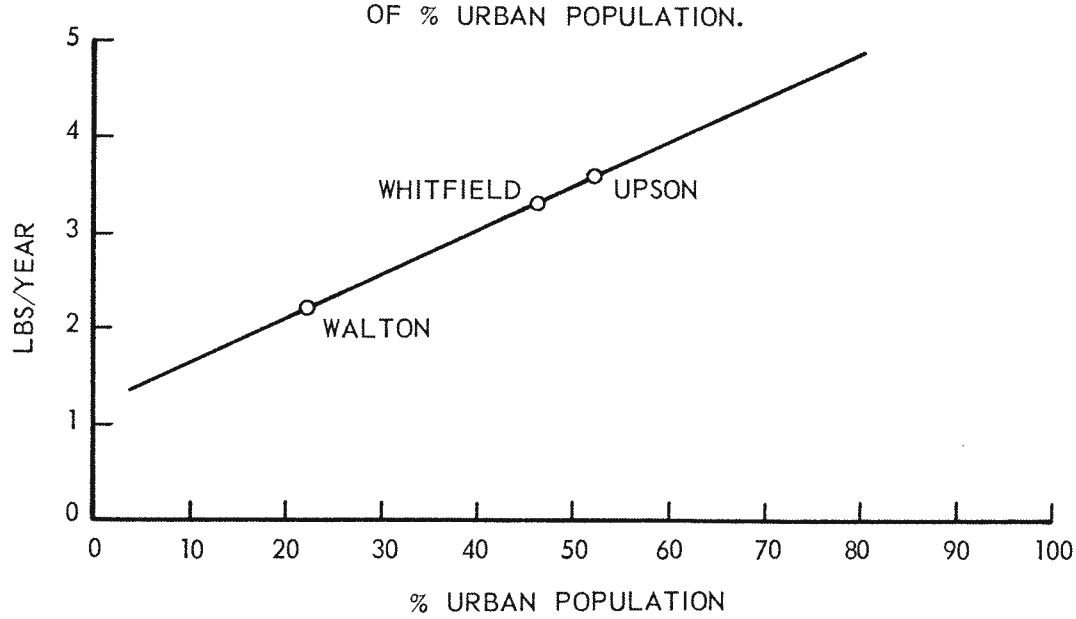
1/ That urban per capita sales are higher than rural ones would seem to be in accordance with the facts, at least under Georgia conditions. Per capita income in the rural sections is relatively low. The argument that the price of the LSD is, within limits, not an important sales factor, is not valid there. On many farms some kind of cheap soap will be used and washings will be less frequent than in town.

per year, approximately 30 per cent higher than the national average.

CHART 5
PER CAPITA L.S.D. SALES IN GEORGIA COUNTIES AS A FUNCTION OF % URBAN POPULATION.



This figure of 3.2 pounds per year is certainly not precise and could be written 3.2 ± 0.3,[1/] but it can be concluded that it is not likely that the southeastern consumption of LSD is below the national average. This is in line with statements of some soap and detergent retailers, interviewed during the survey, who expressed the belief that the Southeast is an excellent area for sales of these products. In order to get a conservative estimate, a round figure of 3 pounds per year was adopted as the per capita consumption of LSD for the Southeast. This figure gives a total consumption for 1958 of 61,500,000 pounds, about 14.4 per cent of the national consumption.

1/ At first sight it appears contradictory that the Southeast, with a lower percentage of urban population than the country as a whole, has nevertheless a higher per capita consumption of LSD. The linear relation between LSD sales and percentage urban population holds, however, only when comparing areas which in other respects are similar--that is, have the same climate, same general economic conditions and same type of population. Therefore, this relation will probably be approximately correct comparing areas within the Southeast, but doe not hold when we compare the Southeast with other zones. One of the reasons for the higher per capita consumption might be the warmer climate, which not only produces different clothing habits, but also entails more frequent change of underwear and shirts and, consequently, more laundering.

Assuming that the Southeast's share of the total national consumption will remain about constant, the future consumption estimates for this area can be derived from those calculated earlier for the nation.

Year	Estimate of Future Consumption of LSD in the Southeast (pounds)	Increase Over Previous Year (pounds)
1959	85,500,000	
1960	105,200,000	19,700,000
1961	130,800,000	25,600,000
1962	158,000,000	27,200,000
1963	187,200,000	29,200,000
1964	217,600,000	30,400,000

These figures show that there is plenty of room for LSD manufacture in the Southeast.

Data obtained from different supermarket chains and individual stores, indicate that two firms, Lever Brothers and Procter & Gamble, control about 70 to 75 per cent of the Southeast market. This reflects the tremendous sales and advertising effort of these companies. Lever's heavy duty detergent "Wisk" is rapidly growing in popularity. Present sales represent probably around 25 to 30 per cent of total LSD volume of the southeastern market.

The only important southeastern producer is Texize Chemicals, Inc., which operates a plant at Greenville, South Carolina. Their share of the six-state market is estimated at about 5 to 10 per cent. This includes products manufactured by them but distributed under other brand names. They produce a number of other products--including liquid starches, disinfectants and specialized cleaning compounds, which are not included in the above estimate. They will soon put another plant in operation in Texas. The nearest detergent plants of the big soap and detergent manufacturers are:

Colgate-Palmolive	Jeffersonville, Indiana
Lever Brothers	St. Louis, Missouri and Baltimore, Maryland
Proctor & Gamble	Cincinnati, Ohio and St. Louis, Missouri

The relation of size of can to sales in the six-state market is approximately as follows:

1/2 or 30,800,000 lbs. sold in 12 and 16 oz. cans
1/3 or 20,500,000 lbs. sold in 22 oz. cans
1/8 or 7,700,000 lbs. sold in 32 oz. and one quart cans
1/20 or 3,100,000 lbs. sold in 1/2 gallon cans

III. PRESENT MANUFACTURING AND DISTRIBUTING FACILITIES; RAW MATERIAL SITUATION

Producers and Their Products

During the survey the following brands of fluid synthetic detergents were encountered:

Manufacturer	Brand Name
Armour & Company	Chiffon
B. T. Babbitt, Inc.	Glim
Colgate-Palmolive Company	Vel
Colonial Stores	3 D
Lever Brothers	Lux
	Wisk (heavy duty)
Procter & Gamble	Joy
	Ivory (introduced recently on the Southeast market; free samples are being distributed)
Purex Corporation, Ltd.	Trend
Sinclair Manufacturing Co.	Coral (just now entering the Southeast market)
Texize Chemicals, Inc.	Texize

The southeastern market is dominated by Lever Brothers and Procter & Gamble, as noted earlier. They account for about 70 to 75 per cent of the six-state market.

Transporting and Retailing the Finished Product

The packaged LSD's used in the home for dishwashing and laundering are almost exclusively sold through the grocery stores. Some chain drug stores handle them, but the quantity passing through this outlet is at the most a few per cent of the grocery sales. The large supermarket chains handle a considerable part--perhaps 20 per cent--of the total volume, but without an extensive and detailed survey it is not possible to give an exact figure.

The average supermarket, chain or independent, sells about nine cases per week of LSD. Supermarket type stores of small size towns sell about three cases per week, large independent grocery stores about one case per week and the small groceries connected with a service station, perhaps one-fourth case per week.

The supermarkets belonging to one of the large chains get their detergents from the company's central warehouses, which in turn buy directly from the manufacturers. Groceries connected with Associated Grocers buy most of

their detergents from the central warehouse of that organization, but buy also directly from the three big soap and detergent manufacturers: Lever Brothers, Procter & Gamble and Colgate-Palmolive. The central warehouse buys directly from manufacturers.

Independent groceries buy most of their supplies from wholesalers but also occasionally directly from salesmen of the "big three." Some of the very small stores seem to buy directly from the latter. Those who buy directly from the manufacturers get, of course, a special price reduction. The products of the only important local LSD manufacturer are apparently all sold through wholesalers.

The Raw Material Situation

The Synthetic Detergent

It has already been mentioned that a great part of the LSD is based on dodecyl bensene sulfonate. Southeastern producers of this product are listed in Appendix D, as are suppliers and manufacturers of raw materials for dodecyl bensene sulfonate. This listing shows that the supply production is good.

The supply production for sulfuric acid, which is used to sulfonate the dodecyl bensene is dealt with in Chapter IV.

Another detergent which seems to have become popular as a heavy duty LSD is a compound produced by reacting tall oil with ethylene oxide. Georgia is a big producer of tall oil, which is a by-product of Kraft paper manufacture. Union Bag & Paper Company has a large plant for tall oil distillation at Savannah, Georgia and Hercules Powder has a similar plant at Savannah. In this case, too, the supply position of a Georgia manufacturer is good. The nearest ethylene oxide producers are:

Olin-Mathieson Chemical Corporation	Brandenburg, Kentucky
Union Carbide Chemical Company	South Charleston and Institute, West Virginia

The Phosphates

The supply position of an Atlanta manufacturer is excellent. Atlanta lies between the two U. S. deposits which produce the most phosphates--those of Florida and those of Tennessee. A list of Southeast producers of phosphates and of phosphorus (raw material for phosphates) is given in Appendix E.

Carboxymethyl Cellulose

The nearest manufacturer is Buckeye Cotton Oil Company, Memphis, Tennessee. Hercules Powder Company has a plant in Virginia.

IV. POSSIBILITIES FOR ESTABLISHING MANUFACTURING PLANTS IN THE SOUTHEAST

A Branch Plant of One of the Big Manufacturers

As has already been noted, only a small part of the LSD consumed by the southeastern six-state unit is produced there. The only known important local producer is Texize Chemicals, Inc. at Greenville, South Carolina. There is, consequently, ample room for local production. Given the large share of the local market held by Lever Brothers and Procter & Gamble, one of the most obvious possibilities is a branch plant of one of these giants in the six-state area. We estimate the Lever market share at about 45 per cent against perhaps 27.5 per cent for Procter & Gamble. In other words, an operation in Georgia by or for one of the two would have the advantage of being a large size operation from the outset.

Lever Brothers is a likely candidate for the following reasons:

(1) Their nearest manufacturing points, St. Louis, Missouri and Baltimore, Maryland are farther away than the giant Procter & Gamble plant at Cincinnati, Ohio.

(2) They presently hold a larger share of the local market.

In this connection it has to be pointed out, however, that it seems unlikely that Lever will be able to maintain its market advantage. Their present superiority is largely based on the recent success of their heavy duty detergent "Wisk." As soon as Procter & Gamble introduces their heavy duty product "Biz," which at present is being test marketed in other areas, it seems likely that Lever's and Procter & Gamble's shares will tend to approach one another.

How could one of the large LSD manufacturers justify a manufacturing operation in the Southeast? The principal justification would be savings on transport costs. The LSD's contain about 50 per cent water and are much heavier than the solid detergent. This makes the problem of transport costs much more important for the liquid than for the solid detergents.

Other justifications of secondary importance are:

(1) small savings, of the order of 10 per cent, on supervision and labor costs;

(2) small savings on the cost of active material, in case the latter is a sulfonated alkyl-aryl product or a sulfonated alcohol, because a Georgia

manufacturer north of Atlanta can obtain sulfuric acid (the principal raw material) cheaper than almost anywhere else in the country;

(3) faster distribution of products in the Southeast market area; with consequent reduction of warehousing needs and costs;

(4) a better labor climate, with reduced possibilities of interruptions by strikes;

(5) a certain good will generated by local production.

There are, however, also some disadvantages:

(1) It would cost Lever Brothers, for example, less to expand their plant in St. Louis or Baltimore than to establish a new plant in the Southeast. They could make use of equipment for powdered detergents and of warehousing and other auxiliary facilities.

(2) Overhead and supervision at Baltimore or St. Louis would be less. For example, the plant manager's salary would be charged only partly to the LSD operation.

(3) In order to establish a plant in the Southeast, trained personnel would have to move to another part of the country.

At first glance it might seem that the extra money Lever Brothers or one of the other large LSD manufacturers would have to invest for a plant in the Southeast (against building it at St. Louis or Baltimore) and the higher supervision and labor costs there would wipe out the advantages. However, a high spot estimate of the capital investment and operating costs of a Southeast LSD plant indicates that significant savings would be achieved. The details are shown in Appendix C.[1/]

A cursory glance over these figures is sufficient to show that raw material and container costs make up almost all of the manufacturing or mill costs. Together they account for 94.8 per cent. The only other items of some importance, percentage wise, are labor-supervision-overhead and depreciation, which nevertheless account for only 2.3 and 1.6 per cent, respectively.

These data lead to the following important conclusions: For this plant the manufacturing costs are, for all practical purposes, directly proportional to the output, for outputs ranging from somewhat less than half to full capacity. In other words, no great benefits accrue from increasing the size of the

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1/ It has to be understood that the calculated investment and operating cost are meant as an illustration only, to indicate order of magnitude. They do not pretend to represent the cheapest or most efficient plant.

operation. To be specific, if the size of the operation were doubled (to use double the amount of equipment) practically the only saving would be some reduction of overhead and depreciation. We estimate the labor and overhead for the double capacity plant at approximately $190,000. That would mean a saving of 2 x 116,000 - 190,000 = $42,000. As a percentage of total manufacturing costs this is insignificant.

If Lever Brothers chose to expand their Baltimore facilities rather than establish a branch plant in the Southeast savings in operating cost would be: in direct labor and overhead, this $42,000, plus some saving on depreciation because some of the facilities for powdered detergents could be used for the liquids. The actual saving on supervision and labor costs would, however, be smaller than this figure. Total wages and salaries in the Southeast are about 10 per cent lower than at Baltimore. Deducting this 10 per cent of total wages and salaries from the $42,000 reduces the savings to $30,000.

The savings in plant investment would be around $350,000, which would represent a reduction in depreciation of $35,000 a year. This figure is probably too high, as actual savings on plant investment are usually smaller than the estimate.[1/] Using this figure of $35,000 a year for depreciation savings, the total saving in manufacturing costs will be $30,000 + $35,000 = $65,000 per year for expanding the Baltimore facilities rather than establishing a branch plant. The savings in transport costs for a Southeast branch plant are of the order of $400,000 a year. (See Appendix C.) This makes the net saving in manufacturing costs in the Southeast $335,000 a year, which would pay back the extra cost of a Southeast plant in a little over a year. This shows that transportation savings alone justify a branch plant in the Southeast.

The calculations in Appendix C are based on the following setup: The active material (the detergent) would be prepared by a local chemical company and shipped in trucks to an Atlanta or Marietta plant. This plant would carry out the formulating, filling and packaging and do some warehousing. The

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1/ The author of this report has had considerable practical experience with the remodeling of existing plants and with fitting operations into existing buildings not designed for that kind of operation. Almost always he has found the actual savings less than had been anticipated. In some cases, where things looked good on paper, it was often attributable to accounting methods, which shifted part of the construction and remodeling expenses to other projects or to "repairs and maintenance." Furthermore, the resulting setup often proved to be cramped and not suitable for most efficient operation or adequate expansion.

sulfonation would not be done by the LSD manufacturer for the following reasons: The enormous Copperhill, Tennessee plant of Tennessee Corporation produces a by-product sulfuric acid which is marketed at $12 f.o.b. plant as of February, 1959 against a national price of $23.50 f.o.b. plant.[1/] This company could produce alkyl-aryl sulfonate inexpensively on the basis of a guaranteed large volume. (The LSD manufacturer would need 6,000,000 pounds per year of sulfonate or about 12,000,000 pounds of slurry.) They could install the latest type of continuous sulfonation plant, have available acid sludge disposal facilities and could easily cope with sulfurous fumes. Together with the low sulfuric acid cost this would give them an extremely strong competitive position.

This setup would offer the following advantages for a LSD manufacturer:

(1) a cheap sulfonate, produced relatively close to the point of consumption;

(2) no storage and handling of oleum;

(3) no higher wages for handling a dangerous chemical like oleum;

(4) no sulfuric acid and acid sludge disposal problems;

(5) no problems with sulfurous fumes.

The above does not imply, however, that other producers could not offer the active material at attractive prices.

In case Lever Brothers, for example, would prefer to prepare its own sulfonate the savings resulting from a Southeast plant would be somewhat reduced. At Baltimore, Lever undoubtedly has sulfonating equipment. LSD sales would presumably decrease the sales of the powders, sulfonating equipment used for the powders could be diverted to LSD production and no additional equipment would be required. The Southeast plant's sulfonating equipment, complete with tanks and building and deducting cost of sulfonate storage tanks, would cost somewhere around $120,000 and represents a $12,000 a year depreciation. The extra investment in the Southeast of $350,000 + $120,000 = $470,000 would be paid back by the net savings of $323,000 in slightly less than 1 1/2 years. In other words, there is no basic change in the savings picture.

1/ Oil, Paint and Drug Reporter, February 2, 1959.

A Southeastern Firm Affiliated With One of the Big Manufacturers

Another interesting possibility would be to have some local formulator, who has spare capacity and wants to broaden his field of operations, do the formulating, filling and packaging for a large LSD manufacturer. The latter would take care of distribution and advertising only. The advantages to the large LSD manufacturer would be:

(1) no capital investment required, since the capital would be put up by the local formulator in return for a contract;

(2) no manufacturing headaches;

(3) in case of an important shift in manufacturing methods, the parent company would not have any capital tied up in obsolete equipment;

(4) no need to adapt personnel policies to southern conditions and the larger companies;

(5) no permanent transfer of specialized technicians to the South, although it probably would be necessary to send down technicians to give instruction and supervise the initial operations of the local formulator.

The calculation of manufacturing costs of this and the previous section is based on a local Lever plant. Lever's share of the Southeast market is estimated as follows:

Year	Per Cent of Total Market
1958	45
1959	40
1960	36
1961	36

This gives the following sales volumes:

Year	Sales Volume (pounds)
1958	27,700,000
1959	34,200,000
1960	37,800,000
1961	47,000,000

At this point it might be argued that the six-state market does not adequately represent the market area of a Georgia operation of or for Lever Brothers. It is not justified to try to settle this point by a detailed analysis of transportation costs. Lever would certainly take several other factors into account including:

(1) efficiency and operating costs at their manufacturing centers close to the Southeast area;

(2) the future of these manufacturing centers--planned increases or decreases in capacity, erection of new plants or closing down of old ones;

(3) frequency of strikes and wage trends at the manufacturing points;

(4) the company's overall distribution plans and policies and

(5) the company's manufacturing policies.

These factors can be determined exactly only by the Lever organization, but a superficial analysis has been made to reveal order-of-magnitude data. Map No. 1 shows where Lever's detergent plants are located. It is not known at which of these plants LSD is manufactured. In order to estimate the smallest market area available, it was assumed that LSD is manufactured in Hammond, Indiana, Baltimore, Maryland, and St. Louis, Missouri. If Atlanta and St. Louis are connected by a straight line, a line drawn at the midpoint of this line perpendicular to it, represents approximately the point where freight rates from Atlanta and St. Louis are equal. On the Atlanta side of this line, Atlanta has the advantage in transport costs; on the other side the St. Louis producer has the advantage. Repeating this procedure for Hammond and for Baltimore defines the approximate boundaries of the market area of an Atlanta producer. This area is larger than the six-state unit used so far. Mississippi is added, while part of Kentucky makes up for what is lost of Tennessee and part of Louisiana compensates for what is lost of South Carolina. This area, in fact, exceeds the six-state unit by an area roughly equal in size to the state of Mississippi. Because of the small percentage of urban population of the latter (27.9 per cent), its contribution to the six-state unit is not very significant--of the order of 8 per cent.

The conclusion is that the market area for a Lever plant at Atlanta is at least equal to the six-state unit we have used for our calculations. If LSD is not manufactured at one or more of the three locations considered, the actual market area of the Atlanta producer increases. Map 1 shows that the absence of LSD-producing facilities at St. Louis would produce the greatest increase in market area. Similar analyses of the market area can be made for other LSD manufacturers.

The above calculations have been based on the hypothetical case of a Lever Brother's branch plant at Atlanta. The picture for a Procter & Gamble branch plant would be similar, with savings somewhat less. There are, of

MAP 1
MARKET AREA FOR A HYPOTHETICAL LEVER BROTHERS BRANCH PLANT AT ATLANTA.

MAP 2
LOCATION OF INDUSTRIAL PLANTS FOR HOUSEHOLD TYPE
PACKAGED SYNTHETIC DETERGENTS.

course, many other local manufacturing possibilities, such as (1) a branch plant which would produce for or under license of manufacturers which hold a small part of the southeastern market, such as Colgate-Palmolive or Purex Company; (2) a branch plant with production for or under license of manufacturers which so far have not sold on the southeastern market but would be interested in doing so--firms like Sinclair Manufacturing Company, Toledo, Ohio; Haag Laboratories, Inc., Blue Island, Illinois; and Fels-Company, Philadelphia, Pennsylvania; and (3) an independent Georgia manufacturer.

All these operations would probably aim at an initial production of 5 to 10 per cent of the local market. Appendix C gives estimates on required investment and operation costs for such a capacity. A prospective LSD manufacturer can estimate from these data what part of total sales he can spend on distribution, advertising, research and plant improvements, or at what price he can sell to a company which does the distribution.

A Completely New and Independent Operation

It may appear that the prospects for an independent Georgia manufacturer are not good. The soap and detergent field is dominated by the three giants as we have noted--Colgate-Palmolive, Lever Brothers and Procter & Gamble. The predominance of these companies would seem to make it almost impossible for a small, independent firm to break into the market. The case of Texize Chemicals shows, however, that it can be done. Nevertheless, the difficulties should not be underestimated. In order to get a start the small local firm has several courses open:

(1) It could carry on an extremely intensive local advertising campaign.

(2) It could bring out a product which has one or more characteristics not possessed by its competitors. For example, the product might contain a special disinfectant (nontoxic to humans) or contain a special perfume.

(3) It could use a very low price container or one which is extremely convenient. (The Appendix contains a note on the possibilities of plastic containers.)

(4) It could allow the wholesaler and/or the retailer a higher mark-up than his national competitors.

(5) It could offer its product to the public at a price below that of national competitors.

Combinations of two or more of these alternatives can, of course, be

used. Whatever the final choice, the entrepreneur should realize that in the beginning he will have to spend practically the entire difference between unit consumer price and manufacturing cost on conquering a market share by some of the methods outlined above.

Since heavy duty LSD's will be responsible for the greater part of future LSD sales, the independent local producer will do well to develop or buy a formula for a heavy duty product in order to capitalize on their expected rapid volume increase.

It would also be well for him to reduce his dependence on a single product by undertaking the manufacture of a number of similar products, that is, products in the sanitary, cleaning or cosmetics field.[1/] He could later concentrate on those which give the highest earnings. These diversification possibilities are discussed in more detail in the next chapter.

The most clearly indicated marketing channels for a local manufacturer would be selling directly to chain supermarkets (and chain drugstores) and selling through wholesalers to other groceries. This is apparently the procedure followed by Texize.

At some localities Lever Brothers and Procter & Gamble sell directly to groceries, even to very small ones. This apparently is done mainly for promotional purposes and to give their products a start at these stores. In this way every store carries their product. The losses which such a procedure might cause are probably charged to advertising. This method probably is not suitable for a small local producer unless he has a lot of experience with and a great interest in distribution and advertising methods and knows how to organize an efficient sales force.

Note

It should be understood that the capacity of plants as described in this chapter can be easily doubled without any additional equipment. The calculations in the Appendix are based on a one-shift operation, which seems to be the normal procedure for plants of this type. Working one additional shift would double the plant's capacity. Working three shifts is not possible because it would not permit enough time for upkeep and repair of the filling

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1/ He should study what competitors like Purex, Clorox, Zep, Selig and especially the Wyandotte plant in Atlanta are producing and plan to produce.

and packaging line. Because plant capacity can be varied so widely without additional equipment, an accurate forecast of the future market is not required. Outputs considerably different from those visualized can be handled by this same plant without any appreciable effect on efficiency and costs. This applies to both the one-line and two-line plants visualized here. The capacities of those plants, based on mixing and filling rates, are roughly:

	One Shift (pounds/year)	Two Shifts (pounds/year)
One-line plant	15 - 25,000,000	25 - 50,000,000
Two-line plant	30 - 50,000,000	50 -100,000,000

V. DIVERSIFICATION POSSIBILITIES FOR AN INDEPENDENT, LOCAL LSD MANUFACTURER

Other Detergent Possibilities

It would be too much of a gamble for an independent, local manufacturer to concentrate on the LSD only. By launching other products at the same time, an independent would increase his chances of success and make use of the spare capacity of his mechanized filling and packaging line. This packaging line would have considerable overcapacity during the early stages of LSD manufacture and its use for other products would somewhat reduce the LSD manufacturing costs.

The LSD's owe their success to the idea of converting a solid product to a liquid one for greater consumer convenience. This seems to be a general trend on which a LSD manufacturer can capitalize. In other words, he can develop new products by offering those now presented as solids in the form of liquids. Examples might be (1) a liquid floor cleaner, (2) a liquid cleaner for stainless steel, and (3) a liquid cleaner for window glass.

Another trend on which an independent might capitalize is offering products in the form of aerosols. This is a rapidly expanding and interesting field. The replacement of a standard filling machine by a specialized type would adapt his filling and packaging line to the handling of aerosols.

Possibilities need not be limited to the field of sanitary products. Cosmetics and polishing compounds should be investigated. Most products in these categories are well adapted to the manufacturing facilities of a formulator.

VI. DETERGENT CONTAINER POSSIBILITIES IN GEORGIA

Appendix C shows that local can manufacture should substantially increase transport savings. LSD's are mostly sold in tin cans, but a change to plastic containers seems likely in the near future. Procter & Gamble has brought out, or will bring out, one of its LSD's in a plastic container and Purex has been selling its "Trend" in a plastic pouch to manufacturers of automatic dishwashing machines.[1/] At present, smaller size plastic containers, such as the 12 and 16 ounce sizes, can be manufactured at the same or slightly lower prices than metal cans. The larger sizes are slightly more expensive than their metal counterparts. It seems likely, however, that plastic container prices will drop, or at least remain constant, whereas those of metal cans are likely to rise.

Local manufacture of plastic cans would seem to be a more likely possibility than tin can manufacture. The erection of equipment for producing plastic containers requires a considerably smaller investment than a metal can manufacturing line. In other words, the volumes contemplated for a branch plant of the producer with the largest share of the southeastern market, which are of the order of:

Year	Number of Cans
1959	25,500,000
1960	28,200,000
1961	35,100,000
1962	42,400,000
1963	50,200,000
1964	58,400,000

would make plastic detergent can manufacturing in Georgia commercially practical at the outset.

In order to justify metal detergent can manufacture in Georgia, a yearly volume of the order of 70,000,000 to 100,000,000 cans would have to be guaranteed. Such a volume will probably not be reached until somewhere around 1964 or 1965. Detailed information about the Georgia tin can manufacturing situation can be found in an earlier Industrial Development Branch study: "Tin Cans, A Manufacturing Opportunity in Georgia," February, 1959, Engineering Experiment Station, Georgia Institute of Technology, Paul B. Han. Since the

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1/ Soap and Chemical Specialties, March, 1958.

draft of this report on LSD was completed, two tin can manufacturers have located plants in the Atlanta area. One has indicated an interest in producing LSD cans if a large enough volume can be assured.

APPENDICES

Appendix A

DERIVING A FORMULA FOR THE INCREASE OF LSD SALES

A formula was derived for the increase of LSD sales. The derivation was based on data published by the Association of American Soap and Glycerine Producers, Inc. on yearly sales of packaged solid and liquid detergents for the period 1948 to 1958. The Association points out that data for different years are not strictly comparable because the number of manufacturers supplying them varies from year to year. These data, however, do represent a high percentage of total yearly sales.

In order to establish approximately what percentage of the total detergent sales the Association's data represent, their 1954 data were compared with those supplied by the 1954 Census of Manufactures. For the solid packaged detergents this gave: (a) Census: 2,156,129,000 pounds; (b) Association: 1,862,137,000 pounds or 86.3 per cent of the Census total. The Association covers only those detergents with end uses similar to soap. For this reason it was estimated that the Association's figures represent about 90 per cent of the total solid detergent sales. Their yearly totals were corrected accordingly.

For LSD sales it was found: (a) Census: 9,056,000 gallons; (b) Association: 8,122,000 gallons, or 90 per cent of the Census total. For the same reason as above, this figure was adjusted. The Association totals for LSD sales were considered to represent 95 per cent of the actual totals.

In order to be able to add the sales figures for LSD to those of the solids it was necessary to convert. The basis for the conversion was the figures published by John W. McCutcheon in his article: "Heavy Duty Liquid Detergents."[1/] He indicates that of a certain LSD formulation 139 grams are equivalent (as to washing effect) with 78.2 grams of solid. Though this figure applies, of course, only to a comparison of specific products, it was adopted as an average value because it was estimated that the error introduced would not be significant. Gallons of liquid detergent were then converted into pounds of liquid by multiplying by 8.8 (density of liquid 1.06) and then converted to solid by multiplying by 78.2/139.

1/ Soap & Chemical Specialties, pp. 43-46, 11, 113, August, 1957.

The total packaged syndet sales obtained this way were converted to per capita figures in order to make them independent of population increases. Furthermore, a deduction was made from the figures for the per capita sales of the year 1947, making this year the origin of the growth curve. This was done in order to eliminate to some extent the growth of the light duty solid detergents. The heavy duty solid detergents were introduced on a big scale in 1948.

The resulting figures give a curve the shape of which is closely approximated by the equation:

$$y = 10^{\left(1.494 - \frac{3.933}{x - 1945}\right)}$$

Appendix B

DETAILS OF PRELIMINARY MARKET SURVEY: DALTON SURVEY

Dalton, Whitfield County, has seven supermarket chain type stores. Figures supplied by store managers added up to 81.5 cases/week (all sizes) for these stores. Nineteen of the approximately 58 smaller groceries in Dalton were random sampled and found to have an average sales per store of 0.95 case/week. Applying this figure to the 58 stores makes their total sales about 55 cases/week. Dalton total sales are therefore:

$$81.5 + 55 = 136.5 \text{ cases per week.}$$

According to the 1958 "Survey of Buying Power" of Sales Management the proportion of value of retail food sales in the county to sales in Dalton is 9,158/8,390. This gives us an approximate figure for LSD sales in Whitfield County of:

$$9{,}158/8{,}390 \times 136.5 = 149 \text{ cases per week.}$$

The estimated 1956 population of Whitfield County is, according to a previous study of the Industrial Development Branch 37,700. This gives a yearly per capita consumption of:

$$149 \times 52/37{,}000 = 0.21 \text{ case.}$$

At a number of stores we succeeded in having the informant check his estimates against his book figures. On the average the book figures were about 20 per cent lower than the estimates:

$$20 \text{ per cent of } 0.21 = 0.42$$

$$\begin{array}{r} 0.21 \\ -0.042 \\ \hline 0.168 \end{array}$$ case per year, adjusted to book figures.

This figure (0.16) represents, however, the sales rate during the second half of 1958, and statistics for the county as a whole indicate that sales during the second half of 1958 were higher than for the first half. In order to adjust the second-half sales data for Whitfield County to make them representative of sales for the whole year, the following calculations were made:

Total packaged LSD sales in U. S. for 1958	46,086,000 gallons
First half sales	21,275,000 gallons
Second half sales	24,811,000 gallons

$$\frac{46{,}086}{2 \times 24{,}811} = 0.93$$ of the second half sales rate is representative of the sales for the year as a whole.

If the relation of second half sales to sales for the entire year for the county as a whole applies also to Whitfield County, the following calculations can be made:

Adjustment factor		Case per capita per year based on 2nd half 1958 sales for Whitfield County		Case per year per capita for 1958 for Whitfield County
0.93	×	0.168	=	0.156

The average case contains 21 pounds of LSD. This gives 21 × 0.156 = 3.3 pounds per year per capita for Whitfield County (LSD consumption).

Appendix C

Table I

REQUIRED INVESTMENT FOR A LARGE BRANCH PLANT, CONTROLLING FROM 36 TO 45 PER CENT OF THE SIX-STATE MARKET

Use of Equipment	Description of Equipment	Quantity Needed	Total Cost (dollars)	
Storage of Raw Materials	50-ton detergent slurry storage tanks, complete, installed	5	28,000	
	350-ft^3 storage bins, complete, installed on roof of blending area	20	56,000	
	Bucket elevators and screw conveyors, installed		14,000	
	Building for storage of minor raw materials		3,000	
	Building for storage of empty cans on top of filling and packaging area, complete with conveyors for bringing cans up from trucks and transporting them to packaging area. Complete with heating, lighting, sprinklers		30,000	
				131,000
Blending Operations	4,000-gallon stainless steel mixing tanks, complete, installed	2		
	4,000-gallon rubber-lined hold up tanks, complete with filters and heat exchangers in discharge line	2	50,000	
	Baldwin load cell weighing systems for mixing tanks, installed	2	10,000	
	Pumps, piping, screw conveyors, installed		18,000	
	Building, with heating, lighting, plumbing, sprinklers		22,000	
				100,000

Table I (Continued)

Filling and Packaging	Complete filling and packaging lines, with air compressor, installed	2	140,000	
	Conveyor line for moving empty, reusable cartons to end of packaging line, installed	1	4,000	
	Building, with heating, lighting, plumbing, sprinklers		36,000	
				180,000
	Sub total			411,000
Storage of Finished Material	Building for storage of 400 to 450 tons of finished material, with heating, lighting, sprinklers		22,800	
	Fork lift truck	1	3,500	
	Pallets	1,000	2,700	
				29,000
Auxiliary Services	Boiler, fully automatic, packaged type, installed with building	1	13,000	
	Laboratory, totally equipped		17,000	
	Water treatment plant, complete, installed		2,500	
	Pumps for sprinkler system, installed		2,500	
	Offices with furniture		13,000	
				48,000
Land	Land, 2 acres, and yard improvements		38,000	38,000
	Sub total			526,000
	Engineering & Construction	30%		158,000
				684,000
	Contractor's fee	6%		41,000
				725,000
	Contingencies	10%		72,000
	Total fixed investment			797,000

Appendix C

Table II

OPERATING COSTS FOR A LARGE BRANCH PLANT, WITH CAPACITY TO COVER FROM 36 TO 45 PER CENT OF THE SIX-STATE MARKET

Item	Cost (Dollars)
Raw materials	2,439,000
Containers	2,250,000
Labor and supervision, overhead (see separate breakdown)	116,000
Maintenance	40,000
Plant supplies	6,000
Power	2,000
Water	1,000
Fuel	10,000
Depreciation	80,000
Property taxes	8,000
Insurance	8,000
	4,949,000

These figures are based on a production rate of about 40,000,000 pounds per year.

Breakdown of labor, supervision and overhead figures:

Direct Labor Costs

Operation	No. of Men Required	Cost (Dollars)
Feeding raw materials	2	7,000
Feeding empty containers	2	7,000
Mixing operations	2	7,600
Packaging	6	22,800
Fork lift operator	1	4,000
Foreman	1	5,000
Oiler	1	3,300
Laboratory technician	1	4,000
	Sub total	60,700

Table II (Continued)

Indirect Labor Costs
(Supervision)

Position	No. of Men Required	Cost (Dollars)
General Manager	1	9,000
Assistant Manager, Chief Engineer	1	7,000
Accountant	1	6,000
Chemist	1	6,000
Bookkeeping machine operator, clerk	2	8,000
Shipping and receiving clerks	2	9,000
General Secretary	1	4,200
Telephone operator, receptionist, auxiliary secretary	1	2,900
Yard man and cleaner	1	3,100
Estimated total for labor, supervision, overhead		115,900

Container costs are based on the following numbers of containers:

Number	Size
10,000,000	12 oz.
10,000,000	16 oz.
5,000,000	22 oz.
3,740,000	quart
1,110,000	1/2 gallon

Appendix C

Table III

REQUIRED INVESTMENT FOR A SMALL BRANCH PLANT OR INDEPENDENT PRODUCER, 7.5 PER CENT OF THE SIX-STATE MARKET

Use of Equipment	Description of Equipment	Quantity Needed	Total Cost (Dollars)	
Storage of Raw Materials	50-ton detergent slurry storage tanks, complete, installed	1	6,000	
	350-ft^3 storage bins, complete, installed on roof of blending area	4	13,000	
	Bucket elevators and screw conveyors		5,000	
	Building for storage of minor raw materials		1,500	
	Building for storage of empty cans, on top of filling and packaging area, complete with conveyors for bringing cans up from trucks and transporting them to packaging area. Complete with heating, lighting, sprinklers		9,500	
				35,000
Blending Operations	2,500 gallons stainless steel mixing tank, complete, installed	1	18,000	
	2,500 gallons rubberlined hold up tank, complete with filters and heat exchangers in discharge line	1		
	Baldwin load cell weighing system for mixing tank, installed		5,000	
	Pumps, piping, screw conveyors, installed		10,000	
	Building, with heating, lighting, plumbing sprinklers		12,000	
	Sub total			45,000

Table III (Continued)

Filling and Packaging	Complete filling and packaging line, with air compressor, installed	1	70,000	
	Conveyor line for moving empty, reusable cartons to end of packaging line, installed	1	4,000	
	Building, with heating, lighting, plumbing, sprinklers		20,000	
				94,000
	Sub total			174,000
Storage of Finished Material	Building for storage of 90 tons of finished material, with heating, lighting, sprinklers		6,800	
	Fork lift truck	1	3,500	
	Pallets	1,000	2,700	
				13,000
Auxiliary Services	Boiler, fully sutomatic, packaged type, installed with building		10,000	
	Laboratory, totally equipped		17,000	
	Water treatment plant, complete, installed		2,000	
	Pumps for sprinkler system, installed		2,000	
	Offices with furniture		10,000	
				41,000
Land	Land, one acre, and yard improvements		20,000	20,000
	Sub total			248,000
	Engineering & Construction	30%		74,000
				322,000
	Contractor's fee	6%		19,000
				341,000
	Contingencies	10%		34,000
	Total fixed investment			375,000

Appendix C

Table IV

OPERATING COSTS FOR A SMALL BRANCH PLANT OR INDEPENDENT PRODUCER, ABOUT 7.5 PER CENT OF SIX-STATE MARKET

Item	Cost (Dollars)
Raw materials	422,000
Containers	390,000
Labor, supervisor, overhead (see breakdown)	76,200
Maintenance	20,000
Plant supplies	3,000
Power	1,000
Water	300
Fuel	5,000
Depreciation	37,500
Property Taxes	3,750
Insurance	3,750
	962,500

These figures are based on a production rate of about 7,000,000 lbs/year.

Breakdown of labor, supervision and overhead figures:

Direct Labor Costs

Operation	No. of Men Required	Cost (Dollars)	
Feeding raw materials	1	3,500	
Feeding containers	1	3,500	
Mixing operations	1	3,800	
Packaging	3	11,400	
Fork lift truck operator	1	4,000	
Foreman	1	5,000	
Oiler	1	3,300	
Laboratory technician	1	4,000	
	Sub total		38,500

Table IV (Continued)

Indirect Labor Costs
(Supervision)

Position	No. of Men Required	Cost (Dollars)
General Manager	1	9,000
Assistant Manager, Chief Chemist, Chief Engineer	1	7,000
Accountant, half time	1	3,000
Bookkeeping machine operator, clerk	1	4,000
Shipping & Receiving clerk	1	4,500
Secretary	1	4,200
Telephone operator, receptionist-secretary	1	2,900
Yard man and cleaner	1	3,100
Estimated total for labor, supervision, overhead		76,200

Container costs are based on the following numbers of containers:

Number	Size
1,730,000	12 oz.
1,730,000	16 oz.
870,000	22 oz.
650,000	quart
195,000	1/2 gallon

Appendix C

Table V

A. SAVINGS IN TRANSPORT COSTS FOR A LARGE SCALE GEORGIA BRANCH PLANT, 45 TO 35 PER CENT OF THE SIX-STATE MARKET

Year	Market Share (per cent)	Volume (pounds)	Transport Saving (Dollars) Without Can Manufacturing in Georgia		With	
				Cumulative		Cumulative
1959	40	34,200,000	318,000	318,000	439,000	439,000
1960	36	37,800,000	350,000	668,000	486,000	925,000
1961	36	47,000,000	436,000	1,104,000	603,000	1,528,000
1962	36	56,800,000	527,000	1,631,000	730,000	2,258,000
1963	36	67,300,000	624,000	2,255,000	864,000	3,122,000

B. SMALL SCALE BRANCH PLANT OR INDEPENDENT PRODUCER, 5 TO 10 PER CENT OF THE SIX-STATE MARKET

1959	7.5	6,400,000	59,000	59,000	82,000	82,000
1960	7.5	7,900,000	73,000	132,000	101,000	183,000
1961	7.5	9,800,000	91,000	223,000	126,000	309,000
1962	7.5	11,800,000	109,000	332,000	151,000	460,000
1963	7.5	14,000,000	130,000	462,000	180,000	640,000

Appendix D

SOUTHEASTERN PRODUCERS OF DODECYL BENZENE SULFONATE
AND ITS RAW MATERIALS

DODECYLBENZENE SULFONATE

Arnold, Hoffman and Company, Inc.	Charlotte, North Carolina
Sun Chemical Corporation	Rock Hill, South Carolina
Tennessee Corporation	Copperhill, Tennessee
Wica Chemicals Inc.	Charlotte, North Carolina

DODECYL BENZENE

Because freight rates are equalized, this product can be obtained outside of the Southeast.

Atlantic Refining Corp.
American Chemicals & Ore Company
Amoco Chemical Company
Baird Chemical Company
Continental Oil Company
Monsanto Chemical Company
Stanalchem, Inc.

Nearest source is probably the Refinery of Continental Oil Company at Lake Charles, Louisiana.

BENZENE

Nearest source are By-Product Coke Oven Plants at Birmingham, Alabama, Tennessee Products and Chemical Corporation at Chattanooga, Tennessee.

PROPYLENE TETRAMERE

Nearest source are the oil refineries in Louisiana.

SULFURIC ACID, OLEUM

Cheapest source: Tennessee Corporation, Copperhill, Tennessee.

Appendix E

SOUTHEASTERN PRODUCERS OF PHOSPHORUS
AND PHOSPHATES

PHOSPHORUS

American Agricultural Chemical Company	Pierce, Florida
Monsanto Chemical Company	Columbia, Tennessee
Shea Chemical Company	Columbia, Tennessee
Tennessee Valley Authority	Wilson Dam, Alabama
Victor Chemical Works	Mt. Pleasant, Tennessee
	Tarpon Springs, Florida
Virginia-Carolina Chemical Corporation	Charleston, South Carolina
	Nichols, Florida

PHOSPHATES

Monsanto Chemical Company	Anniston, Alabama
Victor Chemical Works	W. Nashville, Tennessee
Victor-Carolina Chemical Company	Charleston, South Carolina

Appendix F

SOME CONSUMER PRICES OF LIQUID SYNTHETIC DETERGENTS
(end 1958)

Chiffon	12 oz.	0.34 - 0.41
Joy	12 oz.	0.36 - 0.41
	22 oz.	0.71
Ivory	22 oz.	0.75
	one quart	1.09
Lux	12 oz.	0.36 - 0.41
	22 oz.	0.61 - 0.71
	one quart	0.88 - 1.03
Wisk	one pint	0.41
	one quart	0.73
	1/2 gallon	1.43
Texize	12 oz.	0.29 - 0.34
	22 oz.	0.49 - 0.59
Trend	2 cans of 12 oz.	0.59
Vel	12 oz.	0.37 - 0.41
	22 oz.	0.71